

# The comparison between BeAGLE and E665/HERMES

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# The comparison with E665

Z. Phys. C 61, 179-198(1994)

Data sample:

muon+Xe

Beam momentum: 490 GeV  $\times$  0GeV

$$0.1 < y < 0.85$$

$$1.0 < Q^2 < 100$$

$$0.0035 \text{ rad} < \theta < 6.29 \text{ rad}$$

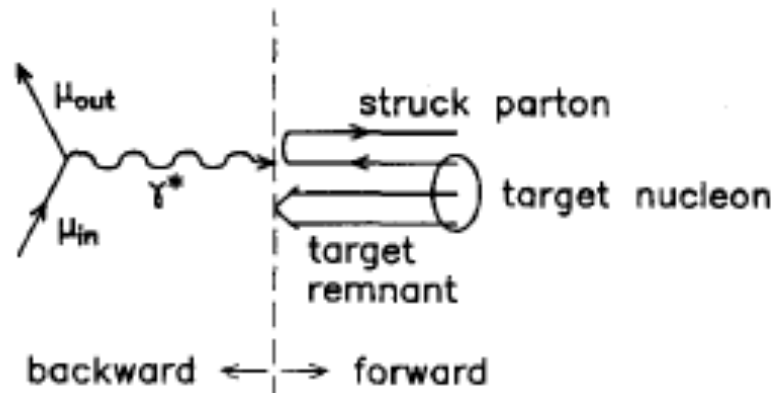
$$8 < W < 30 \text{ GeV}$$

$$X > 0.002$$

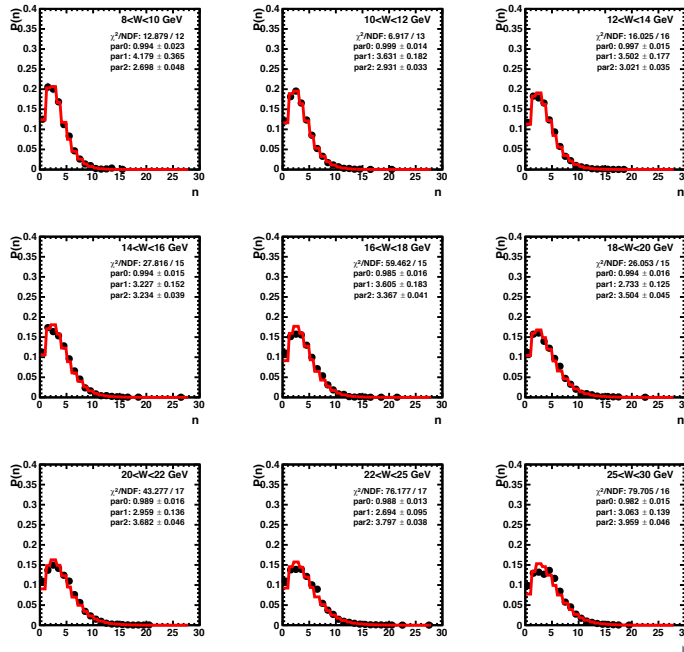
40K events

pdf: CTEQ6

qhat=0, genShd=3



# Multiplicity distribution for backward and forward

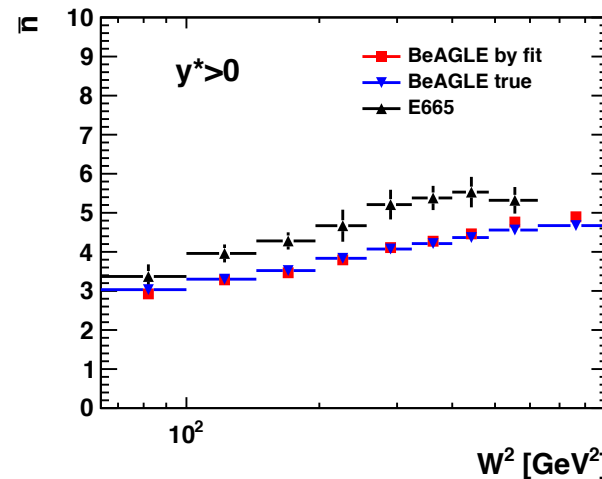
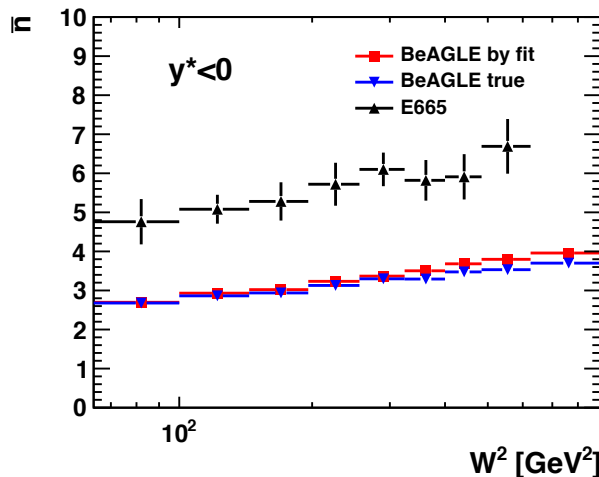


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The hadronic center-of-mass frame is defined by the virtual photon and the target nucleon, the variables in this frame are labelled by a \*.

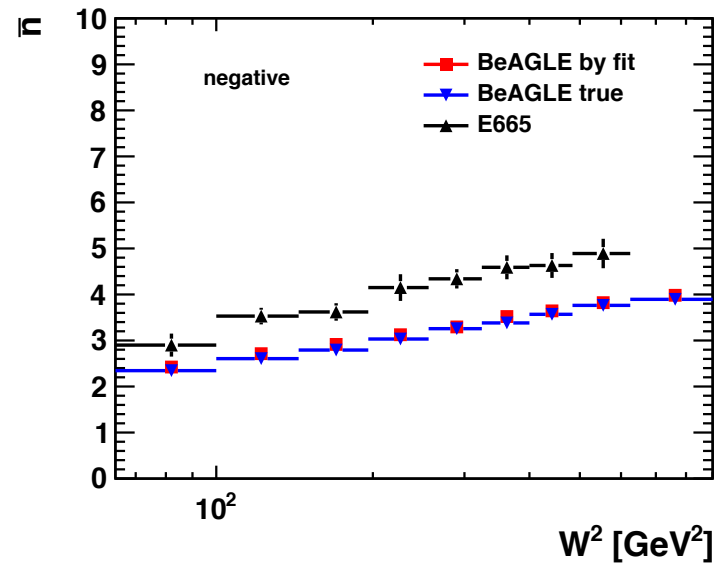
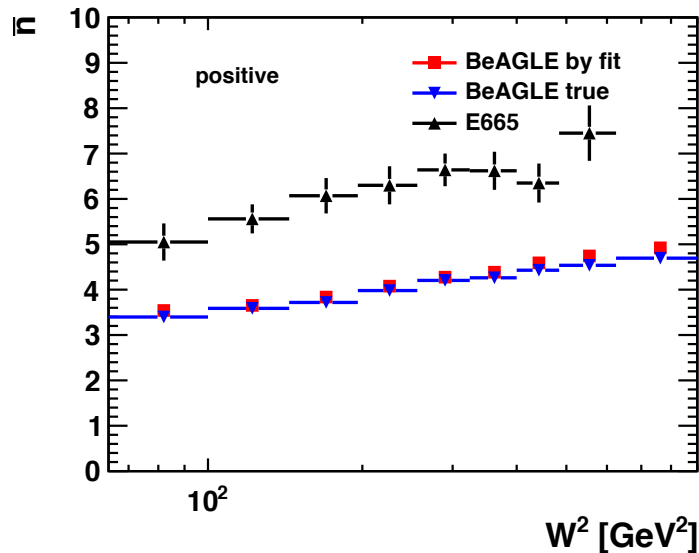
$$P(n; \bar{n}, k) = \alpha \frac{(n+k-1)!}{n! (k-1)!} \left( \frac{\bar{n}}{\bar{n}+k} \right)^n \left( \frac{k}{\bar{n}+k} \right)^k$$

- The average multiplicity  $\bar{n}$  is dependent of  $W^2$
- The fit result is agree with the mean value from the histogram
- The average multiplicity from BeAGLE is smaller than E665



# Average multiplicity distribution for positive and negative

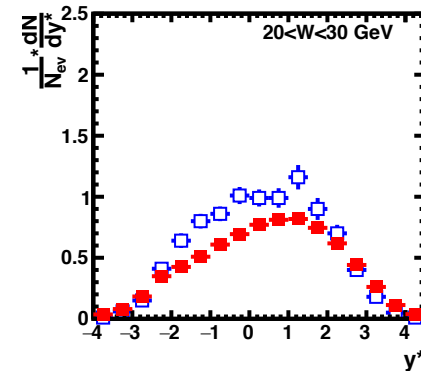
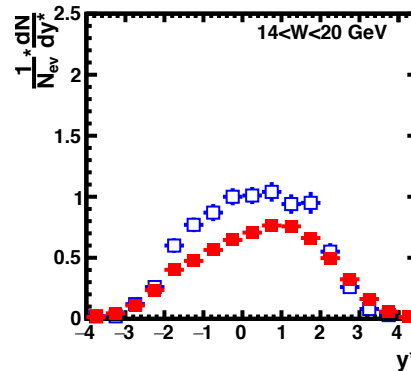
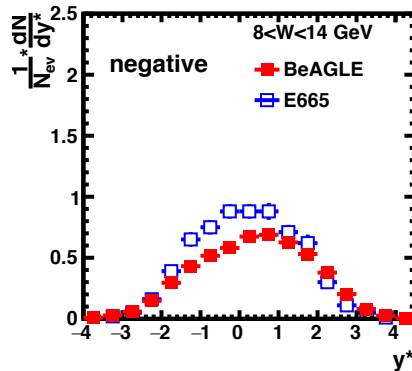
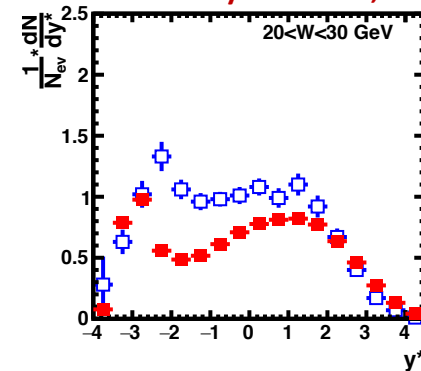
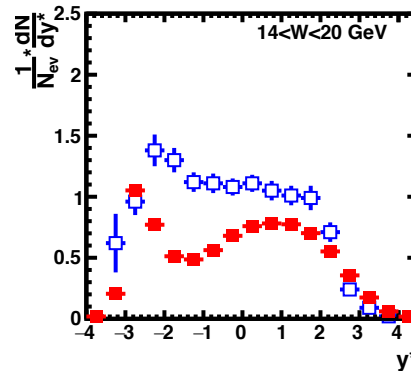
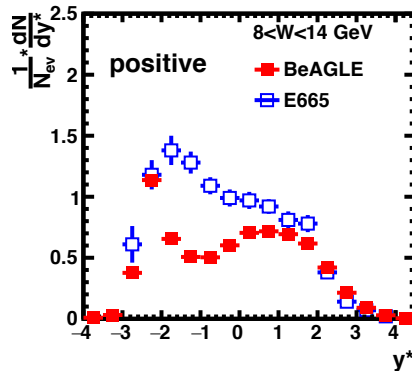
Z. Phys. C 61, 179-198(1994)



- The average multiplicity  $\bar{n}$  increase approximately linearly with  $\ln(W^2/\text{GeV}^2)$
- The fit result is agree with the mean value from the histogram
- The average multiplicity from BeAGLE is smaller than E665

# Normalized cms-rapidity distribution

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- The enhanced positively charged hadron production is observed in the backward region, it is attributed to cascade interaction of the hadrons produced in the initial muon-nucleon interaction
- BeAGLE is smaller in backward and center rapidity than E665, but larger in the region of  $y^* > 2(2.5)$

# Comparison with HERMES

Data sample:

Nucl.Phys. B 780 (2007) 1-27, 2007  
Eur. Phys. J. A 47 (2011) 113

e+Xe e+D

Beam momentum:

27.6 GeV × 0 GeV

$y < 0.85$

$1.0 < Q^2 < 100$

$W^2 > 4 \text{ GeV}^2$

$4 \text{ GeV} < \nu < 23.5 \text{ GeV}$

pdf: CTEQ6

qhat=0, genShd=3

1M events

Hadron selection:

$p_h = 2\text{-}15 \text{ GeV}, z > 0.2$

$$R_A^h(\nu, Q^2, z, p_t^2) = \frac{\left( \frac{N^h(\nu, Q^2, z, p_t^2)}{N^e(\nu, Q^2)} \right)_A}{\left( \frac{N^h(\nu, Q^2, z, p_t^2)}{N^e(\nu, Q^2)} \right)_D}$$

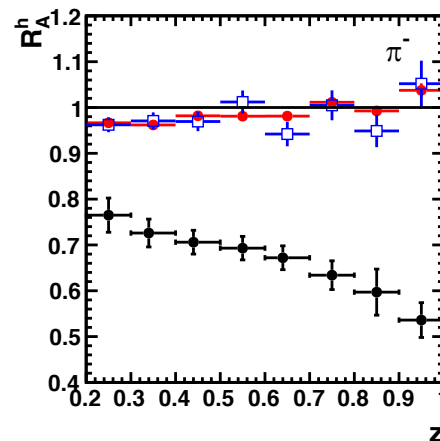
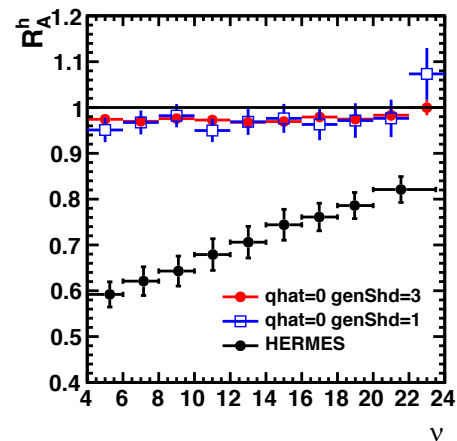
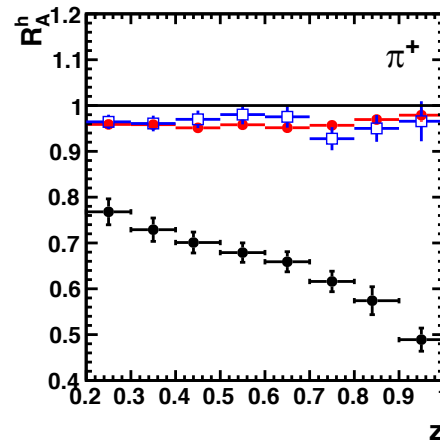
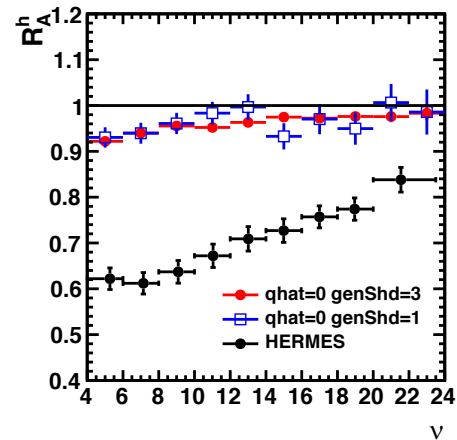
$N^h$ : the number of hadrons in a given  $(\nu, Q^2, z, p_t^2)$  bin

$N^e$ : the number of scattering leptons in the same  $(\nu, Q^2)$  bin

Multiplicity ratios were determined as a function of the virtual-photon energy  $\nu$ , the fractional hadron energy  $z$  and the transverse hadron momentum with respect to the virtual-photon direction  $p_t$

# Dependence of ratio on $\nu$ and $z$ for pion

Nucl.Phys. B 780 (2007) 1-27, 2007



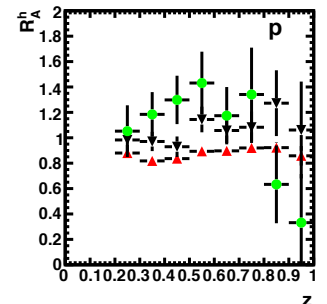
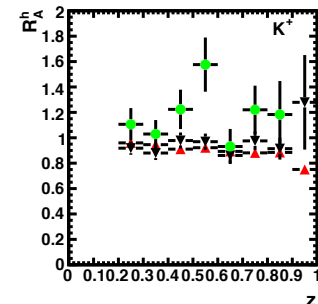
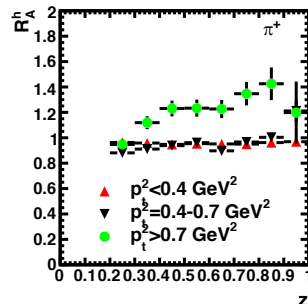
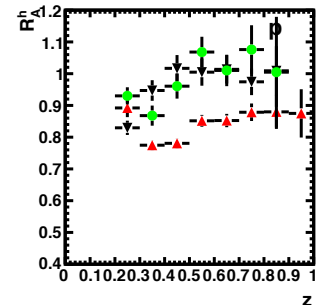
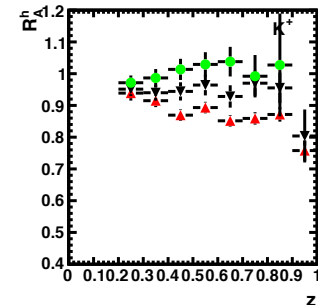
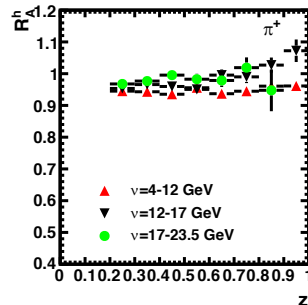
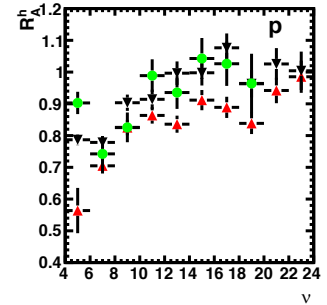
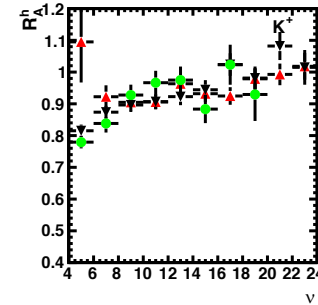
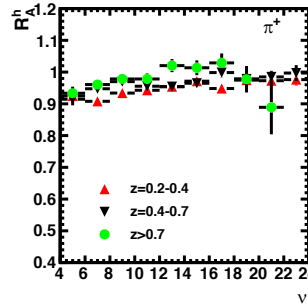
- ✓ The ratio is increase with increasing value of  $\nu$  and decrease with increasing value of  $z$  (due to hadronic rescattering, while a higher energy particle through nuclear reactions produces one or more lower-energy particles).
- ✓ There is large similarity between  $\pi^+$ ,  $\pi^-$ .
- ✓ The distribution from BeAGLE is largely constant with  $\nu$  and  $z$  ( $q_{\text{hat}}=0$ ).
- ✓ The ratio is almost  $< 1.0$  (?inner nuclear cascading).
- ✓ A small dependent on genShd.

# Dependence of ratio on $\nu$ , $z$ and $p_t^2$ from BeAGLE

Dependence of ratio on  $\nu$  for three  $z$  bins, on  $z$  for three  $\nu$  bins and on  $z$  for three  $p_t^2$  bin:

qhat=0 genShd=3

- No global trend of increase with  $\nu$ , decrease with  $z$ . (also for negative hadron)
- The dependence of ratio on  $z$  should be stronger at higher values of  $p_t^2$
- For proton at low  $z$ , ratio should be above 1, due to the final-state interaction.



- ✓ Appropriate parameter setting, should be better



# Summary

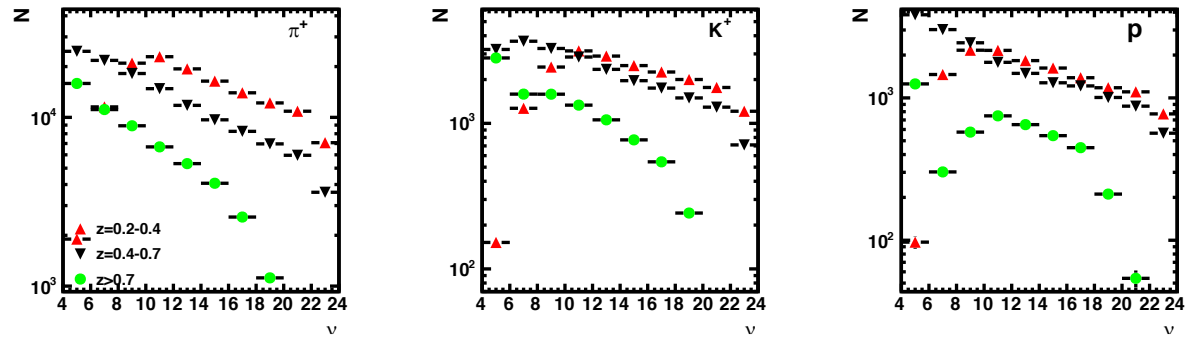
- ✓ The results from BeAGLE are compared with E665 in terms of **multiplicity** distributions, **average** multiplicity, average multiplicity for **forward** and **backward**, average multiplicity for **negative** and **positive**, **rapidity** for forward and backward.
  - ✓ The comparison result with HERMES of **multiplicity ratio** for pion production as a function of the virtual photon energy  **$\nu$** , the fraction  **$z$**  of the energy transferred to the hadron is presented.
- 
- The comparison of multiplicity ratio for other hadrons
  - Tune the parameters to improve the comparison results



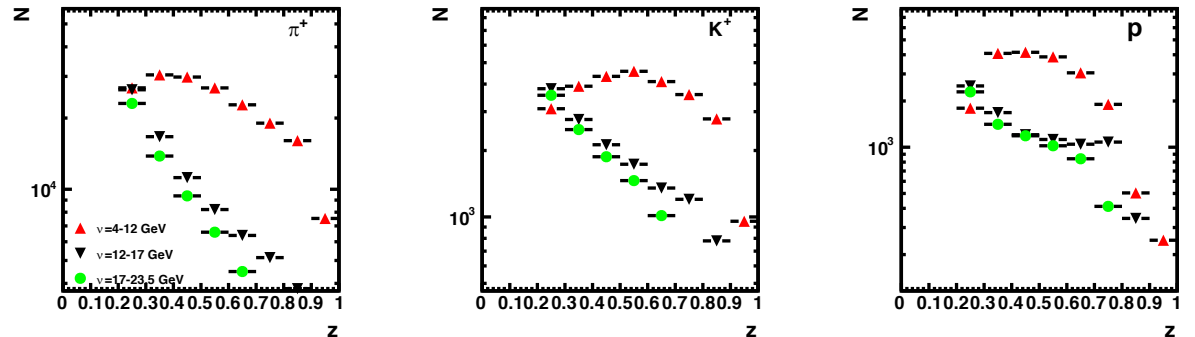
# Back-up

# Positively hadron distribution of eXe from BeAGLE

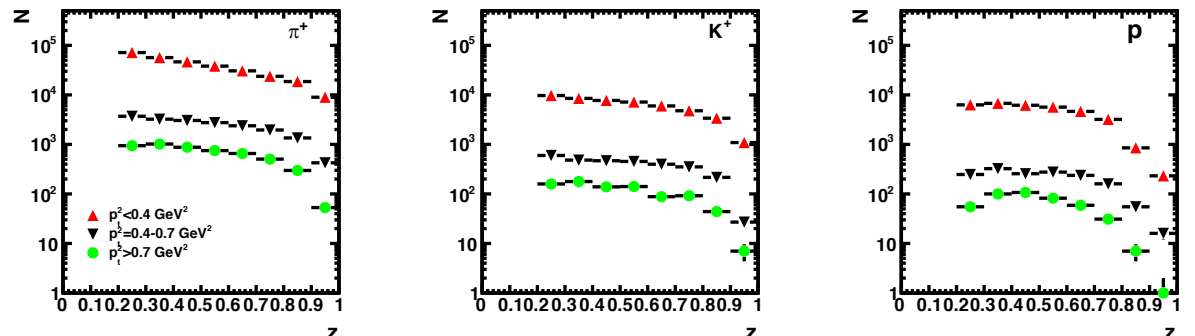
nu VS count in different z bin:



z VS count in different nu bin:

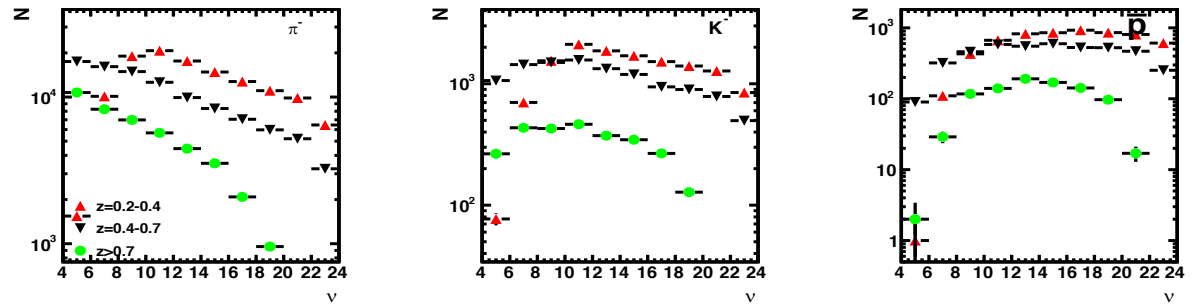


z VS count in different  $p_t^2$  bin:

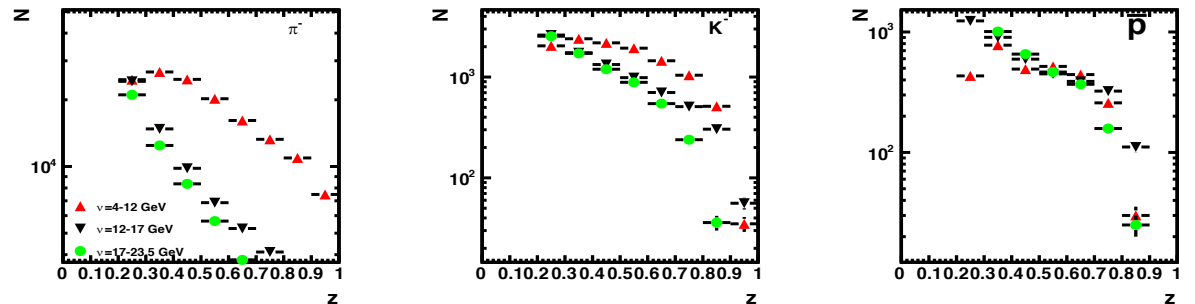


# Negatively hadron distribution of eXe from BeAGLE

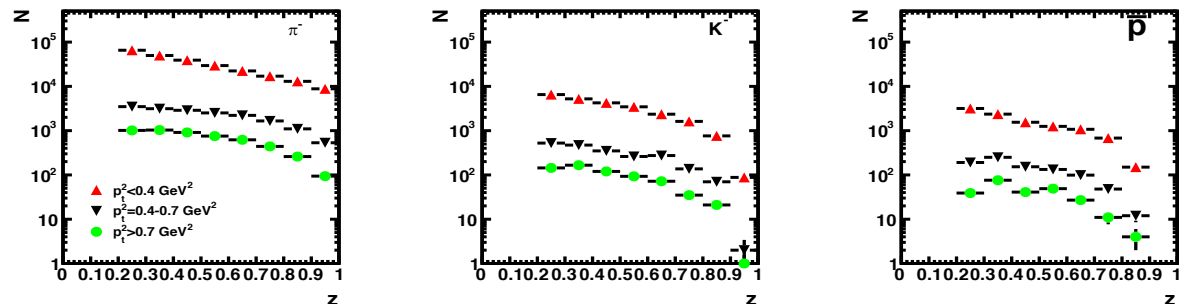
nu VS count in different z bin:



z VS count in different nu bin:

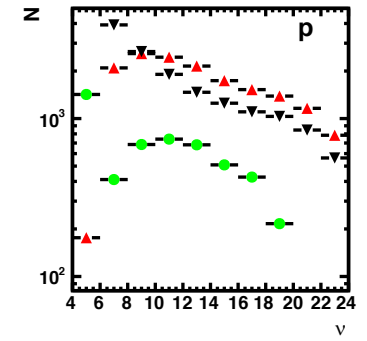
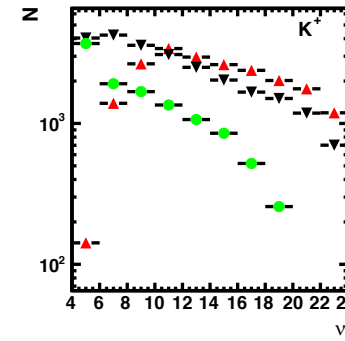
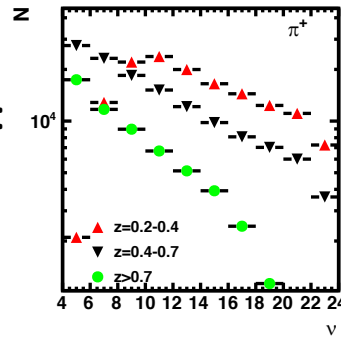


z VS count in different  $p_t^2$  bin:

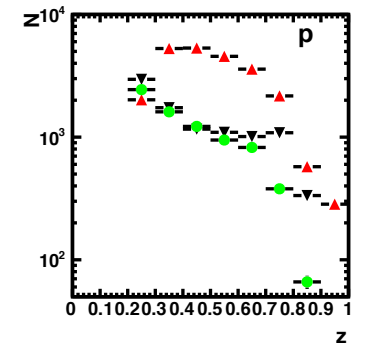
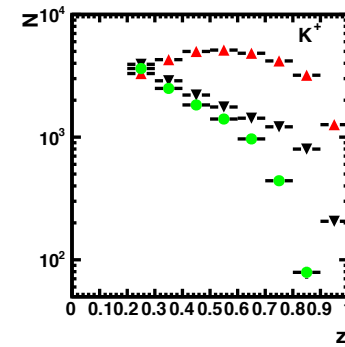
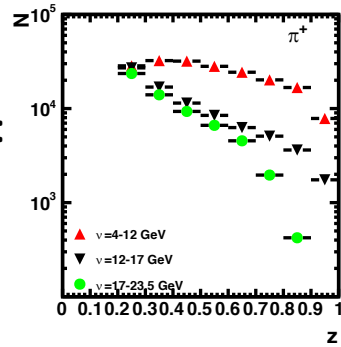


# Positively hadron distribution of eD from BeAGLE

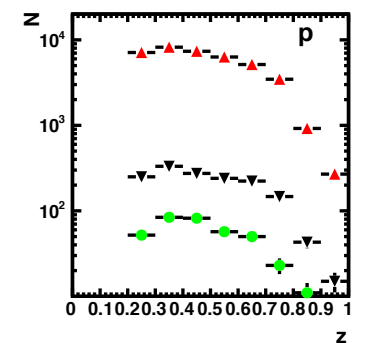
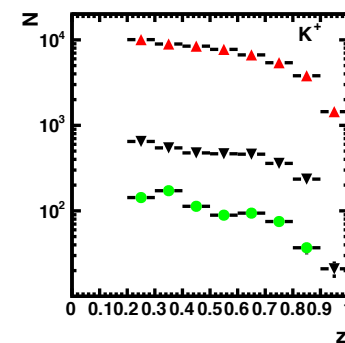
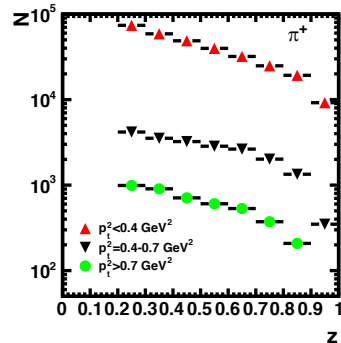
nu VS count in different z bin:



z VS count in different nu bin:

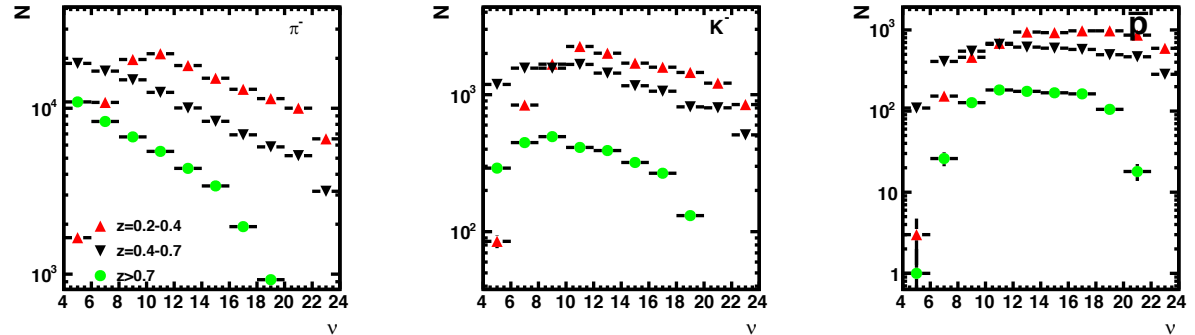


z VS count in different  $p_t^2$  bin:

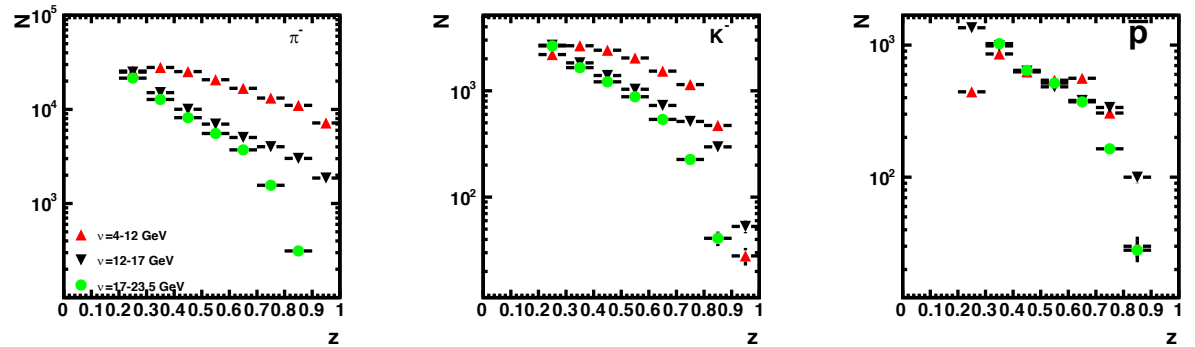


# Negatively hadron distribution of eD from BeAGLE

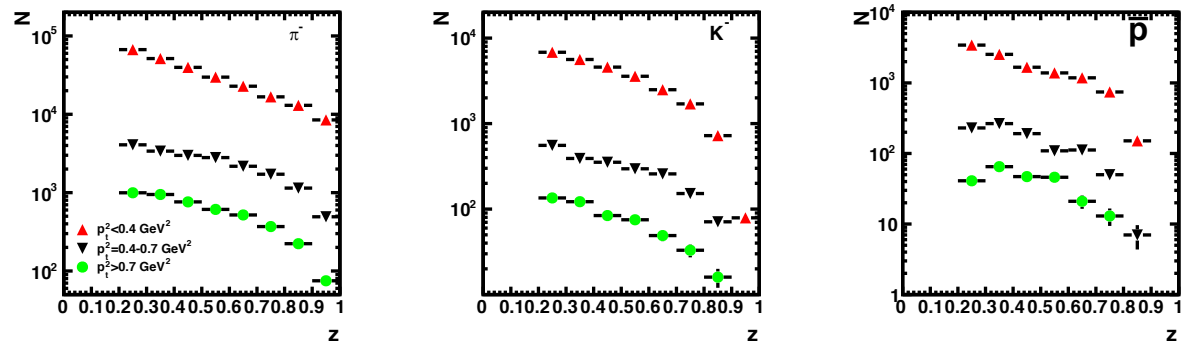
nu VS count in different z bin:



z VS count in different nu bin:

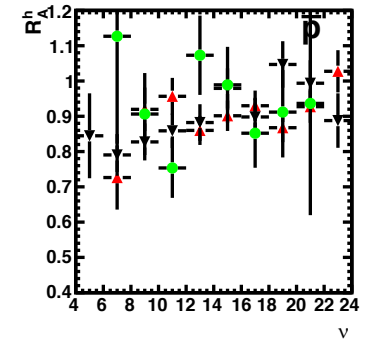
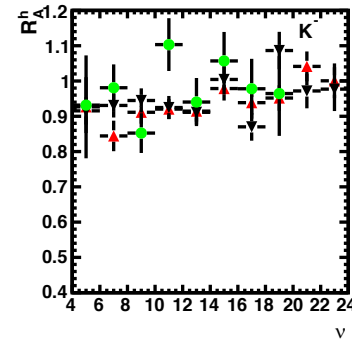
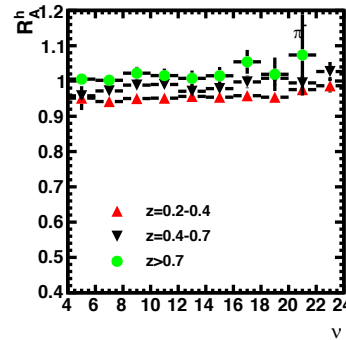


z VS count in different  $p_t^2$  bin:

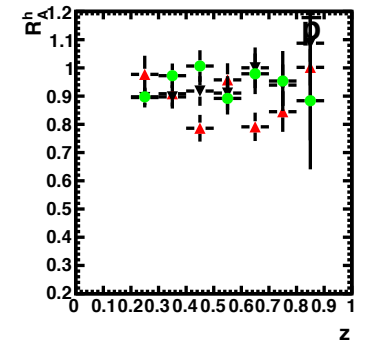
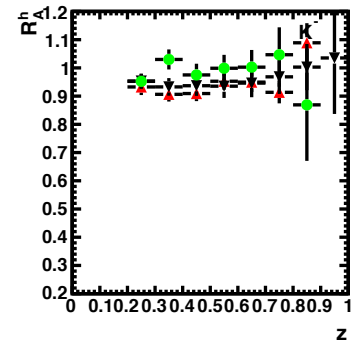
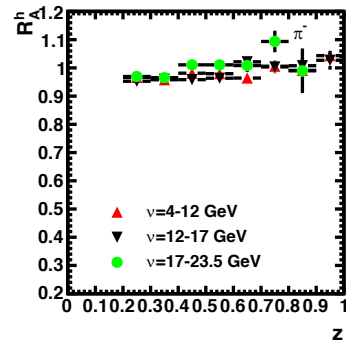


# Ratio( $\pi^-$ , $K^-$ , anti $p$ )

nu VS ratio in different z bin:



z VS ratio in different nu bin:



z VS ratio in different  $p_t^2$  bin:

